

CLAIMS:

1. A composition comprising the admixture or reaction product resulting from combining:
 - (A) a first olefin polymerization catalyst,
 - (B) a second olefin polymerization catalyst capable of preparing polymers differing in5 chemical or physical properties from the polymer prepared by catalyst (A) under equivalent polymerization conditions,
at least one of catalyst (A) or catalyst (B) being capable of forming a branched polymer by means of chain walking or reincorporation of in situ formed olefinic polymer chains, and
 - (C) a chain shuttling agent.
- 10 2. A composition comprising the admixture or reaction product resulting from combining:
 - (A) a first olefin polymerization catalyst capable of forming a highly crystalline ethylene homopolymers by ethylene polymerization;
 - (B) a second olefin polymerization catalyst capable of forming a branched polymer uponpolymerization by means of chain walking or reincorporation of in situ formed olefinic polymer
- 15 chains, and
 - (C) a chain shuttling agent.
3. A process for preparing a high molecular weight, multi-block copolymer comprising contacting ethylene under addition polymerization conditions with a composition comprising: the admixture or reaction product resulting from combining:
 - (A) a first olefin polymerization catalyst,20
 - (B) a second olefin polymerization catalyst capable of preparing polymers differing in chemical or physical properties from the polymer prepared by catalyst (A) under equivalent polymerization conditions,
at least one of catalyst (A) or catalyst (B) being capable of forming a branched polymer by
- 25 means of chain walking or reincorporation of in situ formed olefinic polymer chains, and
 - (C) a chain shuttling agent.
4. A process for preparing a high molecular weight, multi-block copolymer comprising contacting ethylene under addition polymerization conditions with a composition comprising: the admixture or reaction product resulting from combining:
 - (A) a first olefin polymerization catalyst capable of forming a highly crystalline ethylene30 homopolymer by ethylene polymerization;
 - (B) a second olefin polymerization catalyst capable of forming a branched polymer upon polymerization by means of chain walking or reincorporation of in situ formed olefinic polymer chains, and
- 35 (C) a chain shuttling agent.

5. A multi-block copolymer formed from a reaction mixture consisting essentially of ethylene as the addition polymerizable monomer, said copolymer containing therein two or more segments or blocks differing in branching index, said copolymer possessing a molecular weight distribution, Mw/Mn, of less than 3.0.

5 6. A multi-block copolymer formed from a reaction mixture consisting essentially of ethylene as the addition polymerizable monomer, said copolymer containing therein two or more segments or blocks differing in branching index.

7. A multi-block copolymer according to claim 6 possessing a molecular weight distribution, Mw/Mn, of less than 3.0.

10 8. A functionalized derivative of the multi-block copolymer of any one of claims 5-7.

9. A crosslinked derivative of a polymer according to any one of claims 5-7.

10. A crosslinked derivative of a polymer according to claim 8.

11. A polymer according to any one of claims 5-7, or preparable by the method of claim 3 or 4, or a composition comprising the same in the form of a film, at least one layer of a multilayer film, at least one layer of a laminated article, a foamed article, a fiber, a nonwoven fabric, an injection molded article, a blow molded article, a roto-molded article, or an adhesive.

12. A polymer according to claim 8 or a composition comprising the same in the form of a film, at least one layer of a multilayer film, at least one layer of a laminated article, a foamed article, a fiber, a nonwoven fabric, an injection molded article, a blow molded article, a roto-molded article, or an adhesive.

13. A polymer according to claim 9 or a composition comprising the same in the form of a film, at least one layer of a multilayer film, at least one layer of a laminated article, a foamed article, a fiber, a nonwoven fabric, an injection molded article, a blow molded article, a roto-molded article, or an adhesive.

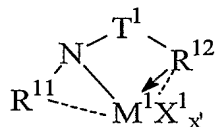
14. A polymer according to claim 10 or a composition comprising the same in the form of a film, at least one layer of a multilayer film, at least one layer of a laminated article, a foamed article, a fiber, a nonwoven fabric, an injection molded article, a blow molded article, a roto-molded article, or an adhesive.

15. A composition according to claim 1 or 2 wherein the shuttling agent is a trihydrocarbyl aluminum- or dihydrocarbyl zinc- compound containing from 1 to 12 carbons in each hydrocarbyl group.

16. A composition according to claim 15 wherein the shuttling agent is triethylaluminum or diethylzinc.

17. A composition according to claim 1 or 2 wherein catalyst (A) comprises a complex comprising a transition metal selected from Groups 4-8 of the Periodic Table of the Elements and one or more delocalized, π -bonded ligands or polyvalent Lewis base ligands.

18. A composition according to claim 17 wherein catalyst (A) corresponds to the formula:



5

wherein:

R^{11} is selected from alkyl, cycloalkyl, heteroalkyl, cycloheteroalkyl, aryl, and inertly substituted derivatives thereof containing from 1 to 30 atoms not counting hydrogen or a divalent derivative thereof;

10 T^1 is a divalent bridging group of from 1 to 41 atoms other than hydrogen; and

R^{12} is a C_{5-20} heteroaryl group containing Lewis base functionality;

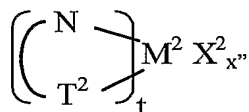
M^1 is a Group 4 metal;

X^1 is an anionic, neutral or dianionic ligand group;

x' is a number from 0 to 5 indicating the number of such X^1 groups; and

15 bonds, optional bonds and electron donative interactions are represented by lines, dotted lines and arrows respectively.

19. A composition according to claim 18 wherein catalyst (B) corresponds to the formula:



wherein

20 M^2 is a metal of Groups 4-10 of the Periodic Table of the elements;

T^2 is a nitrogen, oxygen or phosphorus containing group;

X^2 is halo, hydrocarbyl, or hydrocarbyloxy;

t is one or two;

x'' is a number selected to provide charge balance;

25 and T^2 and N are linked by a bridging ligand.

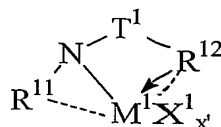
20. A process according to claim 3 or 4 which is a continuous process.

21. A process according to claim 20 which is a solution process.

22. A process according to claim 21 wherein ethylene conversion in the reactor is at least 92 percent.

30 22. A process according to claim 22 wherein the ethylene conversion in the reactor is at least 95 percent.

23. A process according to claim 20 wherein catalyst (A) corresponds to the formula:



wherein:

R^{11} is selected from alkyl, cycloalkyl, heteroalkyl, cycloheteroalkyl, aryl, and inertly substituted derivatives thereof containing from 1 to 30 atoms not counting hydrogen or a divalent derivative thereof;

T^1 is a divalent bridging group of from 1 to 41 atoms other than hydrogen; and

R^{12} is a C_{5-20} heteroaryl group containing Lewis base functionality, especially a pyridin-2-yl- or substituted pyridin-2-yl group or a divalent derivative thereof;

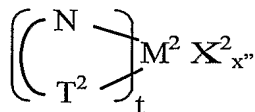
M^1 is a Group 4 metal;

X^1 is an anionic, neutral or dianionic ligand group;

x' is a number from 0 to 5 indicating the number of such X^1 groups; and

bonds, optional bonds and electron donative interactions are represented by lines, dotted lines and arrows respectively.

24. A process according to claim 23 wherein catalyst (B) corresponds to the formula:



wherein

M^2 is a metal of Groups 4-10 of the Periodic Table of the elements;

T^2 is a nitrogen, oxygen or phosphorus containing group;

X^2 is halo, hydrocarbyl, or hydrocarbyloxy;

t is one or two;

x'' is a number selected to provide charge balance;

and T^2 and N are linked by a bridging ligand.

25. A process according to claim 3 or 4 in which the ratio of chain shuttling agent to one or more catalysts and or monomers is varied in order to produce polymers differing in one or more chemical or physical properties.

26. A polymer mixture comprising: (1) an organic or inorganic polymer, and (2) a polymer according to any one of claims 5-7, or preparable by the method of claim 3 or 4.

27. A polymer mixture according to claim 26 wherein component (1) is an organic thermoplastic polymer.

28. A polymer mixture according to claim 27 wherein component (1) is an ethylene or propylene homopolymers or a copolymer of ethylene and a C₃₋₈ α -olefin.

29. A polymer mixture according to claim 27 wherein component (2) is an elastomeric ethylene polymer.